Curriculum Exchange: Framing Engineering – Templates to aid in instructional design

Dr. Nancy Ruzycki, University of Florida

Director of Undergraduate Laboratories, Faculty Lecturer, Department of Materials Science and Engineering
Target Grade Level: K-12

Designed for: Teachers, Content Coaches, Instructional Specialists, CTE leaders, Curriculum Designers

Background
Framing routines are a widely used literacy strategy to support students in the organization of topics, main ideas and details of information. Framing techniques can be used to support teachers in the design of engineering curriculum into the K12 classroom. In this session, several framing templates will be presented. Some templates presented were designed by school districts in Palm Beach County, Florida, while others were developed by the author. These easy to use tools have been presented to, and tested by over 100 teachers in Palm Beach County, Florida during professional development sessions, and have been found to allow teachers to design their own engineering activity within their classrooms based on the specific need of the teacher. Several examples of teacher designed lessons using the templates will be presented.

Using the Frame Routine – teachers use content from their Common Core, and Next Generation Science Standards to design an engineering activity. The frame takes the big ideas from each of the content areas, helps teachers to break the ideas into topics, and then performance tasks that will be incorporated into an engineering activity for students within their grade level. For example, in one professional development session teachers, using strands from social studies, mathematics, science and language arts, designed an engineering activity to “build a better shelter”. Teachers designed an integrated unit where students in grades 3-5 learned about native American shelters, the climate, environment and biomes that these shelters existed in, the mathematics behind the shape, materials and structure of the shelter, and then using an engineering design activity, students designed and tested improved shelters for their selected native culture. Students then communicated their findings through writing and drawing. The Frame Routine guided teachers into finding curriculum learning objectives and knitting them together to create an engineering activity that allowed for integrative learning for students. In addition to the Frame Routine that guides the teacher, there is an Engineering Design Frame that supports teachers in creating the engineering design activity in accordance with accepted engineering design principles. Teachers reported using these frames helped them create integrated units that culminated in an engineering design activity tied to curriculum content.

During curriculum exchange copies of the tools will be available to teachers, and examples of teacher created units using the templates will be shown. Teachers will be able to start to work through and use the design templates to get a better feel for how they can be incorporated into lesson design. These tools are ideal for use in Lesson Study or Professional Learning Communities, or as part of co/team teaching.

Below is an example of a filled Frame:
3rd Grade

**Engineering Idea:** Students will make a model of a particular Native dwelling and seek to improve upon the existing design.

- **Main Idea - mathematics:** Looking for patterns in shape, size, & purpose.
- **Main Idea - science:** The purpose of science.
- **Main Idea - literature:** Compare Native cultures & dwellings from Ancient times.
- **Main Idea - social studies:** Comparing Cultures: Native People.

**Essential details & sketch:**
- Students will see a pattern between dimensions in Native dwellings & use this to improve design.
- Students will investigate the design of a dwelling to create a model for students to design a dwelling.
- Students will ask a dwelling question, related to structure - Students will use engineering design to improve the structure.
- Students will read informational texts to determine types of dwellings & Native culture.
- Students will design a poster to present findings.

**What students will do:**
- Count sizes or dwelling dimensions.
- Look for patterns in shape, size, & purpose.
- Create a question chart.
- Make a comparison chart.
- Make a chart to identify natural resources & habitat.
- Use engineering design to improve the design.

**How will students communicate findings:**
- Students will design a poster to present findings.